

Polish pioneers of local anaesthesia

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The scientific discovery of general anaesthesia is regarded as a breakthrough in the advancement of medical science. On October 16, 1846 Thomas W. Morton performed the first preoperative “ether anaesthesia”, the operating surgeon being Mr. John Collins Warren, Professor of Surgery at Harvard. Nevertheless, forty years had to go by before an ophthalmologist from Trieste, Dr Josef Brettauer, presented the results of a study on the superficial/topical application of cocaine solution for preoperative anaesthesia of the eye conducted by his colleague, Dr Karl Koller (1857–1944), at a congress of German Ophthalmologists in Heidelberg on August 15, 1884 (Koller was financially strapped and could not afford to take part in the congress in person) [1].

This date is considered to have given rise to the era of local anaesthesia which, from then on, was widely employed, most often in ophthalmology and laryngology, since the superficial/topical administration of an anaesthetic agent, namely cocaine, limited the area of anaesthesia to the mucous membranes or conjunctiva. However, the first studies on the use of the infiltration technique in local anaesthesia were conducted four years later by Seweryn Perkowski (1845–1907), a Polish medical doctor, working at the Ujazdowski Hospital in Warsaw at that time, with the results of his study being published in the medical journal “*Medycyna*” (*Medicine*) in 1888 [2–4]. In his article entitled “On local anaesthesia and local anaesthetic agents,” Seweryn Perkowski wrote: “I tested the action of sterile water which I injected subcutaneously and it turned out that these injections work perfectly well to relieve rheumatic pain” [2]. The results of these studies prove that this Polish medical doctor was the actual precursor of the infiltration technique in anaesthesia. Unfortunately, as Perkowski published his study results in a local Polish journal, a German surgeon, Dr. Karol Ludwik Schleich (1859–1922), who presented his anaesthetic technique 6 years later at a congress of German Surgeons in Berlin, is considered to be the inventor of the anaesthetic infiltration technique. Schleich conducted his

study on a group of 3,000 patients (among other agents he also used cocaine) and was probably unfamiliar with Perkowski’s study results. Interestingly, however, Schleich emphasised that he had launched his studies on the infiltration technique in anaesthesia in 1890 after having been inspired by a discussion he had had at the Black Piglet Inn in Berlin with his friend, Stanisław Przybyszewski (1868–1927), then a medical student who later became an accomplished poet and playwright of the Young Poland movement [3–5]. The discussion, which focused on the analysis of the physiology of the nervous system and possibilities of its modulation, was conducted on the basis of very precise pictures presenting the nerve structures drawn by Przybyszewski himself. Both gentlemen inferred that the injection of sterile water into the tissue, by exerting pressure onto the nerve structures, may impair the nerves’ ability to conduct sensory impulses [4, 6]. Karol Ludwik Schleich also emphasised that: “to me, Stanisław Przybyszewski, with his argumentation and drawings, was the spark igniting the fuel of scientific inspiration for my taking up studies on infiltration anaesthesia” [3].

During the time of the dynamic development of local anaesthesia techniques, Polish doctors also conducted studies on the application of these methods. In 1898, at a congress of Polish Surgeons in Cracow, Prof. Rudolf Trzebicki (1859–1903) and Dr Hilary Schramm (1857–1940) from the Surgical Clinic of the Jagiellonian University run by Prof. Rudolf Rydygier (1850–1920), presented the results of a study entitled “On the use of cocaine in local anaesthesia.” Moreover, in 1901, at the 30th Congress of German Surgeons in Berlin, Prof. Jan Mikulicz-Radecki (1850–1905) delivered a talk entitled “On local anaesthesia and local anaesthetic agents” in which he presented 40 cases of subarachnoid anaesthesia.

In the newly independent Poland, i.e. after 1918, the contribution of Polish scientists to the development of anaesthesia was equally dynamic. Doctors working under Prof.



Figure 1. Henryk Hilarowicz (in military uniform; below, sitting — Ryszard Rodziński) [7]

Hilary Schramm (who took over the clinic from Prof. Rudolf Rydygier in 1920) at Jan Kazimierz Clinic of Surgery in Lviv had remarkable achievements in this field. Both a broad scientific interest, far beyond the issues of surgery, and the excellent scientific atmosphere created by Prof. Schramm resulted in the foundation of the Polish School of Regional Anaesthesia in Lviv with Prof. Henryk Hilarowicz and Dr Ryszard Rodziński as its leading members (Fig. 1).

Henryk Hilarowicz was born in Warsaw in 1880. He moved to Lviv at the age of 12 when his father, Prof. Józef Nusbaum-Hilarowicz, an accomplished zoologist and evolutionist, was offered a post at the Faculty of Zoology and Comparative Anatomy at Jan Kazimierz University in Lviv. Young Henryk soaked up the academic atmosphere and inherited the enthusiasm for scientific work from his father. He studied medicine at the Faculty of Medicine at Lviv University, where in 1914 he was conferred with a Doctor of Medical Science degree. During World War I, he was a military doctor in the Austrian army. He showed his patriotism and courage during the Defence of Lviv against

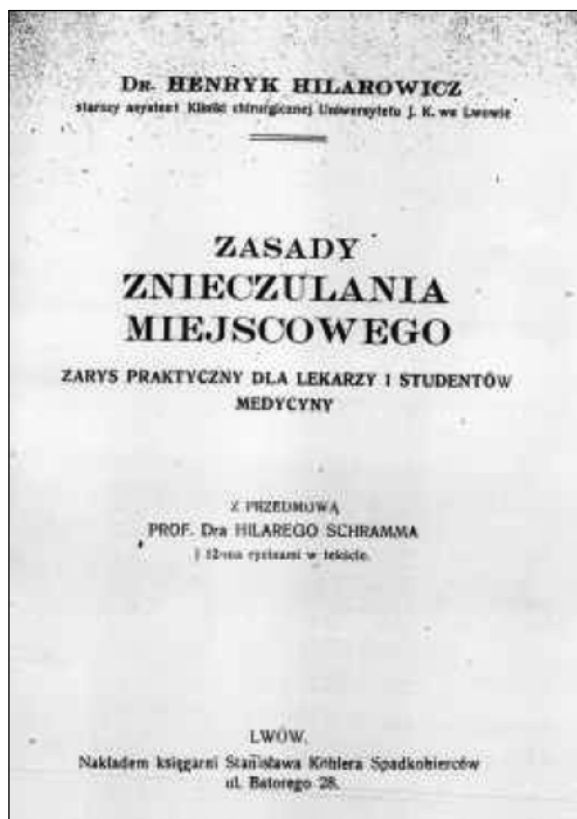


Figure 2. The first Polish handbook on conduction anaesthesia entitled: *The Principles of Local Anaesthesia* (published by St. Koblen & Co., Lviv, 1924)

Ukrainian nationalists in 1918, serving as a doctor in the 3rd Air Group. Right after the war, he started working at the gynaecological-obstetrics clinic in Lviv. In 1921, he became an assistant at the Clinic of Surgery at Lviv University under Prof. Schramm who created an excellent scientific atmosphere encouraging his associates to broaden and update their knowledge, travel abroad, publish articles and deliver papers at scientific congresses. At the Lviv Clinic, Dr Hilarowicz, together with Dr Ryszard Rodziński worked on the optimisation and implementation of new methods of local anaesthesia. Dr Hilarowicz was promoted to professor in 1927, becoming a fellow of the International Society of Surgeons in Brussels in 1929. On the recommendation of Prof. Tadeusz Ostrowski, he was awarded the title of associate professor in surgery at Jan Kazimierz University in Lviv. Hilarowicz was the author of numerous papers on conduction anaesthesia and abdominal cavity surgery. In 1924, St. Koblen & Co. published the first Polish handbook on the techniques of conduction anaesthesia, entitled *The Principles of Local Anaesthesia* (Fig. 2), while in 1925 Książnica Atlas published another handbook of his entitled *First Aid in Emergencies*.

In 1922, in Issue 47 of the *Polish Medical Newspaper*, Henryk Hilarowicz published an article entitled "On the issue

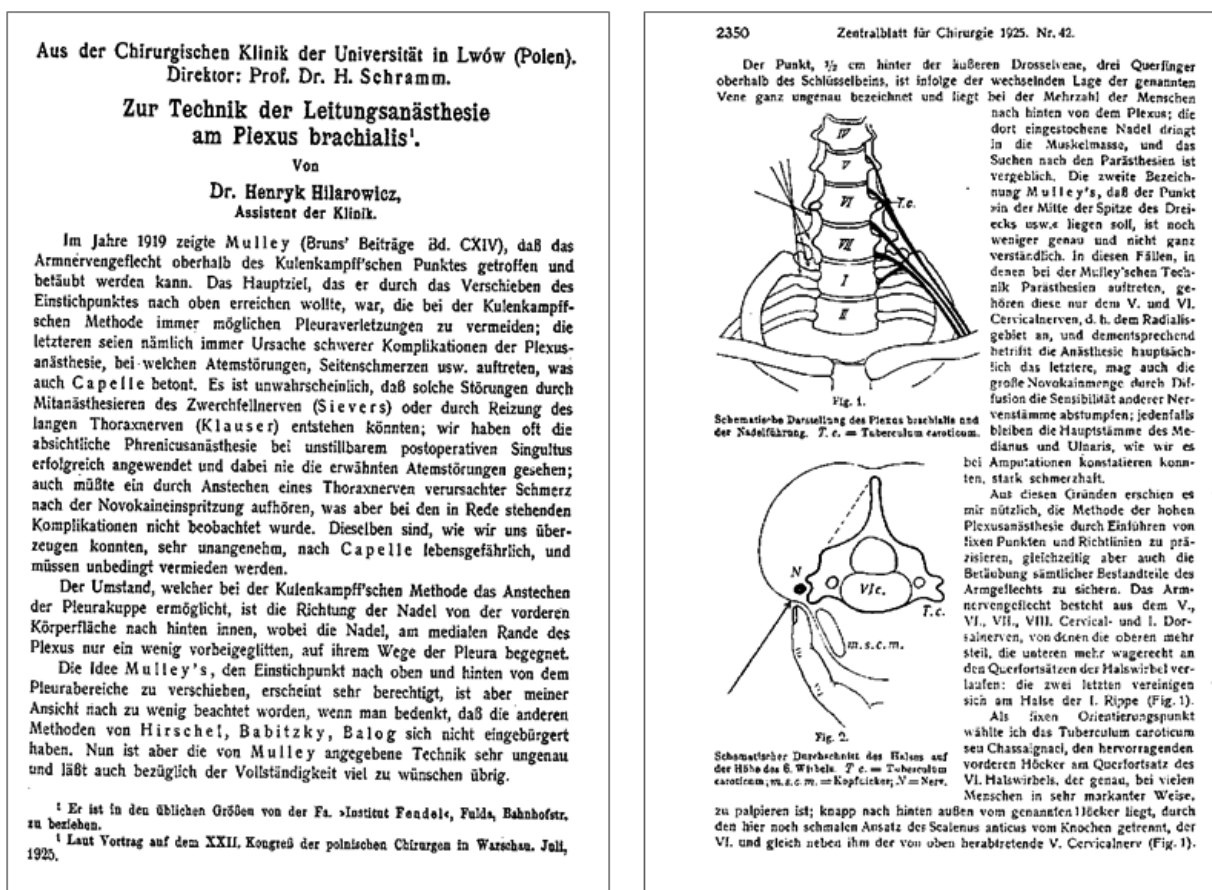


Figure 3. Hilarowicz H. Zur Technik der Leitunganästhesie am Plexus Brachialis. Zentralblatt für Chirurgie 1925; 42: 2349–2351 [8]

of the second branch of the trigeminal nerve anaesthesia”, while the following year his paper entitled: “Practical remarks on techniques and certain modes of local anaesthesia” was published in Issue 27 of the *Polish Medical Newspaper* (PGL). Hilarowicz’s book *On the Failures and Hazards of Some Techniques of Local Anaesthesia* was published in Issue 1 of the *Polish Medical Newspaper* in 1927 while his papers were also published abroad. Two of his articles on local anaesthesia, namely: “Zur Technik der Leitunganästhesie am Plexus Brachialis” from 1925, and “Zur Frage der Lokalanästhesie bei Magenoperationen” from 1927 appeared in Issues 42 and 54 of *Zentralblatt für Chirurgie*, respectively.

Henryk Hilarowicz deserves a special place in the history of anaesthesia for being a pioneer in the field of local anaesthesia. He was the first doctor in the world to demonstrate anaesthesia of the brachial plexus with the access via the scalene muscles. A description of this method was published in *Zentralblatt für Chirurgie* in 1925 [8] (Fig. 3).

Since this technique was described by Hilarowicz 45 years prior to the publication of A.P. Winnie’s [9], I will take the liberty of citing the words of the author: “...I chose the anterior tubercle of the transverse process of the sixth cervical vertebra, known as the Chassaignac tubercle, as

the stay landmark. The cervical tubercle separates the anterior scalene muscular band, still narrow at this altitude, from the fifth and sixth cervical nerves. The technique of anaesthesia is as follows: in the supine position, the head is tilted strongly backwards and turned in the opposite direction, with the index finger of the left hand we palpate the anterior-lateral surface of the vertebral column alongside the posterior dorsal part of the sterno-cleidomastoid muscle which we strongly push away towards the midline. The row of anterior tubercles of the lateral processes of the vertebral column terminates roughly three fingers above the point of division of the clavicle into the medial and internal third part. The Chassaignac tubercle is the more protruding point in question. Slightly externally and below the cervical tubercle, a narrow band of tense anterior scalene muscle and the crevice separating it from the muscle situated posteriorly may be felt, especially in thin patients. This is exactly where the brachial plexus nerves should be looked for. Marking the cervical tubercle with the pulp of the index finger of the left hand, we choose the injection site to be roughly 5 mm externally and 5 mm below the cervical tubercle, with the right hand we make a puncture with a thin needle, about 8 mm-long with no syringe attached and we aim directly at

the spinous process of the sixth cervical vertebra, or a little anteriorly in relation to it. At the depth of about 1 cm, we cause, immediately or after a while, a tingling sensation resulting from the contact of the needle with the fifth and sixth cervical nerves mainly in the posterior part of the shoulder and in the region of the bifurcation of the radial nerve, i.e. as patients usually report, in the thumb. At this localisation of the needle, we inject 5 mL of 2% novocaine solution with adrenal gland extract...."

Henryk Hilarewicz was a surgeon and the author of approximately 100 publications, mainly on gastrointestinal tract surgery and surgical methods concerning arterial hypertension treatment. However, the special place that he deserves in the history of medicine is connected with the development of local anaesthesia since he was the first doctor to describe the technique of brachial plexus anaesthesia with access via the scalene muscles. After Poland had lost its independence in 1939 and during the Soviet occupation of Lviv, Prof. Hilarowicz was the head of the surgical ward of the Military Hospital No. 604 located in Lviv. In July 1941, Lviv was captured by the German army. On July 4, 1941, during the early hours of the morning, he was taken from his home by German SS officers and, on the very same night, he and other Polish professors from Lviv universities were brutally murdered on the Wulecki Heights [10].

Ryszard Rodziński was born in Split in Dalmatia in 1890. His father was a military doctor, Herman Józef Rodziński, while his mother's maiden name was Wiszniewska. Ryszard's father, having finished his medical studies at the University of Vienna, joined the Austro-Hungarian Army in 1887 and, after Poland had won its independence, he became a military doctor in the Polish Army where he was promoted to Brigadier General. After graduating from secondary school, Ryszard Rodziński studied medicine at Lviv University, where shortly before the outbreak of the First World War, he earned the academic degree of Doctor of Medical Science. After the completion of his studies, he started his professional and scientific career at the Clinic of Surgery at Lviv University where he spent 12 years of his life. He worked as an assistant with distinguished professors of surgery, first with Ludwik Rydygier and later with Hilary Schramm. In 1926, Ryszard Rodziński took up an independent post of Head of the Paediatric Surgery Department in St. Sophia's Paediatric Hospital, while in 1936, he became the head of the largest 200-bed surgery department in the National Public Hospital in Lviv [11].

In Ryszard Rodziński's time at the Lviv Clinic of Surgery two central blocking techniques were known and routinely used, namely lumbar anaesthesia, which was literally subarachnoid anaesthesia, and so-called sacral anaesthesia (namely epidural anaesthesia via the sacral region). Unfortunately, administration of these types of anaesthesia

carried the risk of complications and even death, with the percentage of both being high. Such complications mainly resulted from the necessity of administering high doses and volumes of local anaesthetic agent.

Ryszard Rodziński conducted in-depth research into the mechanisms of adverse reactions and post-anaesthetic spinal cord injury complications. In order to evaluate the changes in intracranial pressure after the administration of increasing volumes of epidurally introduced anaesthetic fluid, he initially performed his studies on dogs and cadavers. Later, his experimental studies were transferred into clinical surroundings where Rodziński measured, among other things, the cerebrospinal fluid pressure in the lumbar segment of the vertebral column after the administration of different volumes (from 10 to 7 mL) of 0.9% NaCl or 1% procaine solution via the sacral access in patients undergoing urological procedures [12].

Searching for a safe local anaesthetic for abdominal area operations, Rodziński was the first scientist in the world to show interest in combining both types of anaesthesia applied to the region of the spinal cord (spinal epidural anaesthesia). He performed the procedure in the following sequence: with the patient turned into the left lateral position he conducted epidural anaesthesia via the sacral access using 30–40 mL of 1% procaine, while next, also via the sacral access, he administered 4 mL of 1% procaine with adrenalin into the subarachnoid space. In order to perform subarachnoid anaesthesia, Rodziński recommended that a needle as thin as possible should be used, aptly associating the rate of post-anaesthetic headaches with the gauge of the needle. This type of anaesthesia, labelled by Rodziński as "sacral lumbar", was, according to the current nomenclature, a combined subarachnoid epidural anaesthesia (combined spinal-epidural analgesia) and was used not only in surgery but also in gynaecology, obstetrics and urology. In July 1922, in his report entitled "On combined subarachnoid-epidural anaesthesia", which was delivered at the 19th Congress of Polish Surgeons in Warsaw, Rodziński gave an account of his scientific experience gained from the use of combined subarachnoid-epidural anaesthesia for gynaecological, urinary and surgical operative procedures and emphasised the method's efficacy and safety, due to a possible reduction of the necessary procaine dose, without compromising the quality of anaesthesia. The same findings were also described in the articles published in the Polish Medical Journal in 1923 [13], as well as in *Zentralblatt für Chirurgie* [14], the main surgical journal of German-language regions. All this gave him a prestigious place in the pantheon of pioneers of local anaesthesia (ryc. 4).

Unfortunately, serious health problems, a congenital heart defect, as well as tuberculosis, got in the way and

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angewandt ohne je zu versagen. Das beste Kriterium für die Güte der Methode ist wohl die Tatsache, daß Verf. öfters gezwungen war, in seiner Privatklinik septische Operationen vorzunehmen und am gleichen Tage auswärts sich geburts-
hilflich zu betätigen, vor allem Ausräumen der Nachgeburt — ein an die Asepsis wohl die größten Anforderungen stellender Eingriff —, daß es doch nie zu einem septischen Prozeß kam. Von zwei Kollegen, darunter einem Chirurgen, wurde diese Methode mit gleich gutem Resultat an zahlreichen Fällen erprobt.

Die Vorzüge dieses Verfahrens bestehen somit in folgendem:

- 1) Schnelle (in 10 Minuten) und sichere Händedesinfektion.
- 2) Langdauernde Reduktion der effektiven Keimabgabe.
- 3) Geringe Giftigkeit.
- 4) Keine Reizwirkung.
- 5) Bequeme Handhabung.
- 6) Verhältnismäßige Billigkeit.
- 7) Lange Haltbarkeit der Lösungen.
- 8) Fast völlige Geruchlosigkeit.

Eine Nachprüfung wird den Wert dieses Verfahrens wohl weiterhin bestätigen.

VI.

Aus der Chirurgischen-Klinik der Universität Lwów (Lemberg).
Direktor: Prof. Dr. H. Schramm.

**Über eine neue Betäubungsmethode
der unteren Körpergebiete: Sakrolumbalanästhesie.**

Von
Dr. R. Rodziński,
Assistent der Klinik.

An der Chirurgischen Universitätsklinik in Lwów verwenden wir seit 1 ½ Jahren, bei Operationen im Bereich der unteren Extremitäten und der unteren Abschnitte der Bauchhöhle die von mir erprobte und eingeführte »Sakrolumbalanästhesie«, ein neues Betäubungsverfahren, dessen bisheriger Erfolg seine Veröffentlichung, mit gleichzeitigem Ersuchen um weitere Erprobung, vollumfänglich rechtfertigt. Das Verfahren beruht darauf, daß, durch die gleichzeitige intra- und extradurale Einführung kleiner, für den Organismus unschädlicher Gaben des Betäubungsmittels (Novokain), derselbe Erfolg, sowohl in bezug auf den Umfang, als auch auf die Zeitdauer der Anästhesie, erreicht wird, wie wir ihn von jedem der vorgenannten Räume getrennt, jedoch nur bei Anwendung weit höherer Gaben, zu erreichen pflegen.

Mit anderen Worten, wir erreichen mit unserem Verfahren denselben Erfolg, den wir mit der sogenannten hohen Sakralanästhesie oder mit der Lumbalanästhesie (jedoch nur in der gegenwärtigen Anwendungsform) zu erreichen pflegen, ohne den Pat. den Gefahren der beiden letzteren Methoden auszusetzen.

Die ermittelten Einzelgaben betragen: 4–5 ccm einer 1%igen Novokainlösung (d. i. 0,04–0,05 g Novokain) intradural und 40–50 ccm einer gleichfalls 1%igen Novokainlösung (d. i. 0,4–0,5 g Novokain) extradural eingeführt.

Es ist wohl bekannt, daß an die Ausführung einer Leistenbruchoperation bei intraduraler Einführung von 0,04 g Novokain in 1%iger Lösung nicht zu denken

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ist, weil Leistenbrüche infolge Innervation des Operationsfeldes von höheren Rückenmarksabschnitten aus, nicht immer, selbst bei Anwendung viel höherer Novokaindosen und in bedeutend stärkerer Konzentration, schmerzlos operiert werden können. Eine Dosis von 0,04–0,05 g Novokain in 1%iger Lösung (4–5 ccm einer 1%igen Novokainlösung) führt eine nur sehr kurzdauernde und nicht ausreichende Betäubung herbei, in welcher ein schwerer, länger dauernder operativer Eingriff — wie wir uns wiederholt zu überzeugen Gelegenheit hatten — nicht ausgeführt werden kann, wogegen die gleichzeitige Einführung der beiden vorangeführten kleinen Einzelgaben für gewöhnlich eine ausgezeichnete Betäubung der unteren Extremitäten und der unteren Abschnitte der Bauchhöhle herbeiführt, von 1–2stündiger Dauer.

In der Sakrolumbalanästhesie wurden bisher ungefähr 200 Operationen ausgeführt, darunter Leistenbruch- und Wasserbruchoperationen, Exstirpation und Resektion des Mastdarms, Sectio alta, Prostataktomie, Amputation der unteren Extremitäten, Resektion des Knies und Hüftgelenkes u. dgl.

Das Verfahren versagte in 3 Fällen, in welchen jedoch begangene technische Fehler nicht ausgeschlossen werden können.

Wie bereits erwähnt liegt der Hauptvorteil des Verfahrens darin, daß bei gleich guter Betäubung, wie wir sie mit der hohen Sakral- oder der Lumbalanästhesie (in der augenblicklichen Anwendungsform) erreichen, der Pat. den zahlreichen Gefahren, Neben- und Nachwirkungen dieser beiden Methoden nicht ausgesetzt wird.

Außer Kopfschmerzen leichteren Grades, welche in nur 8% unserer Fälle auftraten, beobachteten wir keine der bekannten unangenehmen und unerwünschten Erscheinungen, welche insbesondere bei der Lumbalanästhesie beobachtet werden und ihre wesentliche Einschränkung in der Chirurgie zur Folge hatten. Auch die Gefahren der hohen Sakralanästhesie sind zu gut bekannt, als daß sie hier erörtert werden sollten.

Die Kopfschmerzen dauerten in unseren Fällen 1–3 Tage, erforderten niemals ein energischeres therapeutisches Eingreifen, wie z. B. Lumbalpunktion oder Infusion physiologischer Kochsalzlösung u. dgl.

Meiner Ansicht nach dürfte der Ausfall der unangenehmen Nebenerscheinungen bei unserem Verfahren, außer der geringen Dosis des (0,04–0,05 g) intradural und (0,4–0,5 g) extradural einverleibten Novokains, vorzüglich auch dem geringen Konzentrationsgrad (1%) zuzuschreiben sein, in welchem das Anästhetikum intradural eingeführt wird.

In den letzten 10 Fällen bedienten wir uns einer Dosis von 5 ccm einer ½%igen Novokainlösung (d. i. 0,025 g Novokain) zur intraduralen Injektion, ohne einen Mißerfolg verzeichnet zu haben. Wir mußten nur etwas länger den Eintritt der Betäubung abwarten, welche bei Anwendung einer 1%igen Lösung momentan eintreten pflegt.

Wenn wir erwägen, daß die Literatur bei Anwendung der Lumbalanästhesie keinen Todesfall zu verzeichnen hat, sofern die Dosis von 0,05 Novokain in 1%iger Lösung nicht überschritten wurde, und daß auch bei Anwendung der sogenannten tiefen Sakralanästhesie (d. i. 0,4–0,5 g Novokain in 1%iger Lösung extradural) bisher kein Todesfall verzeichnet erscheint, so können wir ruhig unser Verfahren nur insofern als gefährlich ansehen, als die Lumbalpunktion als solche und die mit ihr verbundene Infektionsgefahr des Duralisackes in Betracht gezogen wird, welcher Umstand jedoch, bei der heutigen Asepsie, bei Beurteilung unseres Verfahrens kaum in die Wagschale fallen dürfte.

Figure 4. Rodziński R. Über eine neue Betäubungsmethode der unteren Körpergebiete: Sakrolumbalanästhesie. Zentralblatt für Chirurgie 1923; 50: 1249–1251 [14]

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two cases that received 4 mg of morphine in 20 ml normal saline were unrelieved of pain. There was also such a high incidence of the now well known undesirable side-effects,¹⁻⁴ that I came to the conclusion that it is unethical to use it. It may be that preservative-free pethidine^{10,11} or fentanyl¹² would be less troublesome, but for the present I have reverted to relying on the appropriate dose and concentration of bupivacaine.

The ideal long acting drug for postoperative analgesia via the epidural route and allowing for early patient mobilisation is not yet available, but in the future it may be that the simultaneous administration of a subarachnoid anaesthetic and some ultra-long-acting epidural analgesic via a single intervertebral space will provide both surgical anaesthesia and prolonged postoperative analgesia with patient mobility, without the need for an indwelling epidural catheter.

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Another single space technique for orthopaedic surgery

Many orthopaedic surgeons are not happy with epidural analgesia. They complain that it does not give adequate muscle relaxation and that it is not satisfactory for surgery on the ligaments. We, therefore, routinely use isobaric subarachnoid spinal analgesia with 0.5% bupivacaine for surgery on the lower limbs unless the technique is contra-indicated; this provides good conditions for operations lasting for up to 4 to 6 hours; in addition we have, in the past, also introduced an epidural catheter through a different space in a few cases. Such an epidural catheter may be used to supplement the spinal analgesia if it is showing signs of wearing off, to prolong the analgesia into the post-operative period and to provide a route for an epidural infusion of saline should this be desirable if the subarachnoid block causes a 'spinal' headache.

The use of separate spaces for the subarachnoid block and the epidural catheter made the process a time consuming procedure, however; we, therefore, now use the same interspace for both procedures. The epidural space is first entered with a 16-gauge spinal needle and a longer 25-gauge spinal needle is passed through it and into the subarachnoid space; the required dose of 0.5% bupivacaine (isobaric) is then injected. The 25-gauge spinal needle is then withdrawn and an epidural catheter inserted through it into the epidural space. There is no need for undue haste in inserting or arranging or fixing the epidural catheter in position, as an isobaric solution (0.5% bupivacaine) is being used for the subarachnoid block.

We have now used this single space technique on 15 patients with very satisfactory results and without complications.

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Figure 5. Mumtaz MH, Daz M, Kus M. Another single space technique for orthopaedic surgery (letter), *Anaesthesia* 1982, 37 (1): 90 [15]

brought his professional and academic career to a standstill. In January 1938, because of his deteriorating health, he left for Vienna to receive treatment and died there on March 12, 1938, aged only 48 years old. Indeed, one Lviv newspaper wrote about "the premature death of one of the best Polish surgeons, a man of extreme kindness and 'crystal-clear' character" [7].

Professor Marian Kuś was a medical doctor whose scientific studies were closely connected with Dr Rodziński's scientific work and who also contributed to the development of local anaesthesia. He was the founder and organiser of the Pain Management Department at the Cracow medical school in 1978, and later, during the period 1994–1997, was the Head of the Chair and Department of Anaesthesiology and Intensive Care at Jagiellonian University Medical College. About 60 years after Ryszard Rodziński's publication, Professor Kuś and his associates, Dr Mumtaz and Dr Daz, were the first to demonstrate a technique of local anaesthesia known today as *combined spinal-epidural analgesia*. This method was presented in the "Letters to Editor" section of the journal *Anaesthesia* in 1982 [15] (Fig. 5). Professor Marian Kuś died in Cracow on May 30, 2010.

ACKNOWLEDGEMENTS

1. Source of funding: none.
2. Conflict of interest: none.

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